



SEQUENCE LISTING

<110> Board of Trustees for University of Arkansas

<120> Mitogen-Activated Protein Kinase and Method of Use to Enhance Biotic and Abiotic Stress Tolerance in Plants

<130> UAF-03-14

<140> 60/444,249

<141> 2004-01-31

<160> 10

<170> PatentIn version 3.2

<210> 1

<211> 1396

<212> DNA

<213> Oryza sativa

<400> 1

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accagccgcc catcatgccc attggccgcg gcgcctacgg gatcgtctgc tccgtgatga	240
actttgagac gagggagatg gtggcgataa agaagatcgc caacgcgttc aacaacgaca	300
tggacgcaa gcgcacgctc cgggagatca agctcctcag gcacctcgac cagagaaca	360
tcataggcat cagggatgtg atcccgcgc cgatccctca ggcgttcaac gacgtctaca	420
tgccacgga gctcatggac accgacctcc atcacatcat ccgctccaac caagaactgt	480
cagaagagca ctgccagtat ttctgtacc agatcctgcg ggggctcaag tacatccact	540
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<210> 2
<211> 368
<212> PRT
<213> Oryza sativa

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<400> 2

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Gly Arg Tyr Leu Leu Tyr Asp Ile Phe Gly Asn Lys Phe Glu Val Thr
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```

```

Asn Lys Tyr Gln Pro Pro Ile Met Pro Ile Gly Arg Gly Ala Tyr Gly
          35          40          45

```

```

Ile Val Cys Ser Val Met Asn Phe Glu Thr Arg Glu Met Val Ala Ile
          50          55          60

```

```

Lys Lys Ile Ala Asn Ala Phe Asn Asn Asp Met Asp Ala Lys Arg Thr
65          70          75          80

```

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Leu Arg Glu Ile Lys Leu Leu Arg His Leu Asp His Glu Asn Ile Ile
          85          90          95

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Gly Ile Arg Asp Val Ile Pro Pro Pro Ile Pro Gln Ala Phe Asn Asp
          100          105          110

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```

Val Tyr Ile Ala Thr Glu Leu Met Asp Thr Asp Leu His His Ile Ile
          115          120          125

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Arg Ser Asn Gln Glu Leu Ser Glu Glu His Cys Gln Tyr Phe Leu Tyr
130 135 140

Gln Ile Leu Arg Gly Leu Lys Tyr Ile His Ser Ala Asn Val Ile His
145 150 155 160

Arg Asp Leu Lys Pro Ser Asn Leu Leu Leu Asn Ala Asn Cys Asp Leu
165 170 175

Lys Ile Cys Asp Phe Gly Leu Ala Arg Pro Ser Ser Glu Ser Asp Met
180 185 190

Met Thr Glu Tyr Val Val Thr Arg Trp Tyr Arg Ala Pro Glu Leu Leu
195 200 205

Leu Asn Ser Thr Asp Tyr Ser Ala Ala Asp Val Trp Ser Val Gly Cys
210 215 220

Ile Phe Met Glu Leu Ile Asn Arg Gln Pro Leu Phe Pro Gly Arg Asp
225 230 235 240

His Met His Gln Met Arg Leu Ile Thr Glu Val Ile Gly Thr Pro Thr
245 250 255

Asp Asp Glu Leu Gly Phe Ile Arg Asn Glu Asp Ala Arg Lys Tyr Met
260 265 270

Arg His Leu Pro Gln Tyr Pro Arg Arg Thr Phe Ala Ser Met Phe Pro
275 280 285

Arg Val Gln Pro Ala Ala Leu Asp Leu Ile Glu Arg Met Leu Thr Phe
290 295 300

Asn Pro Leu Gln Arg Ile Thr Val Glu Glu Ala Leu Asp His Pro Tyr
305 310 315 320

Leu Glu Arg Leu His Asp Ile Ala Asp Glu Pro Ile Cys Leu Glu Pro
325 330 335

Phe Ser Phe Asp Phe Glu Gln Lys Ala Leu Asn Glu Asp Gln Met Lys
340 345 350

MAPK5.ST25

Gln Leu Ile Phe Asn Glu Ala Ile Glu Met Asn Pro Asn Ile Arg Tyr
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<210> 3
<211> 1084
<212> DNA
<213> Oryza sativa

<400> 3
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accagccgcc catcatgccc attggccgcg ggcctacgg gatcgtctgc tccgtgatga 240
actttgagac gaggagatg gtggcgataa agaagatcgc caactgacac ctcaagatct 300
gcgacttcgg gctggcgcg cgcgtcgcg agagcgacat gatgacggag tacgtggtca 360
cccgggtggtta ccgcgcgcg gagctgctgc tcaactccac cgactactcc gccgccatcg 420
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gcagggacca catgcaccag atgcgcctca tcaccgaggt gatcgggacg ccgacggacg 540
acgagctggg gttcatacgg aacgaggacg cgaggaagta catgaggcac ctgccgcagt 600
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ccgtctatac ctgctttgta catatgatca agattgagag ccgggtagac tgaacattgc 960
atctgtttgt ttgttgatgt tcgaaacca cattctctgc aagttgtggc tgctttgtat 1020
gatatatggt actatgttcg aataaaaggg tttggaactt tggattaaaa aaaaaaaaaa 1080
aaaa 1084

<210> 4
<211> 266
<212> PRT
<213> Oryza sativa

<400> 4

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Gly Gly Arg Tyr Leu Leu Tyr Asp Ile Phe Gly Asn Lys Phe Glu Val
20 25 30

Thr Asn Lys Tyr Gln Pro Pro Ile Met Pro Ile Gly Arg Gly Ala Tyr
35 40 45

Gly Ile Val Cys Ser Val Met Asn Phe Glu Thr Arg Glu Met Val Ala
50 55 60

Ile Lys Lys Ile Ala Asn Cys Asp Leu Lys Ile Cys Asp Phe Gly Leu
65 70 75 80

Ala Arg Pro Ser Ser Glu Ser Asp Met Met Thr Glu Tyr Val Val Thr
85 90 95

Arg Trp Tyr Arg Ala Pro Glu Leu Leu Leu Asn Ser Thr Asp Tyr Ser
100 105 110

Ala Ala Ile Asp Val Trp Ser Val Gly Cys Ile Phe Met Glu Leu Ile
115 120 125

Asn Arg Gln Pro Leu Phe Pro Gly Arg Asp His Met His Gln Met Arg
130 135 140

Leu Ile Thr Glu Val Ile Gly Thr Pro Thr Asp Asp Glu Leu Gly Phe
145 150 155 160

Ile Arg Asn Glu Asp Ala Arg Lys Tyr Met Arg His Leu Pro Gln Tyr
165 170 175

Pro Arg Arg Thr Phe Ala Ser Met Phe Pro Arg Val Gln Pro Ala Ala
180 185 190

Leu Asp Leu Ile Glu Arg Met Leu Thr Phe Asn Pro Leu Gln Arg Ile
195 200 205

Thr Val Glu Glu Ala Leu Asp His Pro Tyr Leu Glu Arg Leu His Asp

MAPK5.ST25

210	215	220
Ile Ala Asp Glu Pro Ile Cys Leu Glu Pro Phe Ser Phe Asp Phe Glu		
225	230	235 240
Gln Lys Ala Leu Asn Glu Asp Gln Met Lys Gln Leu Ile Phe Asn Glu		
	245	250 255
Ala Ile Glu Met Asn Pro Asn Ile Arg Tyr		
	260	265

<210> 5
 <211> 26
 <212> DNA
 <213> Artificial

<220>
 <223> gene-specific primer containing restriction site

<400> 5
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26

<210> 6
 <211> 25
 <212> DNA
 <213> Artificial

<220>
 <223> gene-specific primer containing restriction site

<400> 6
 gctctagatt caatctagta ccgga

25

<210> 7
 <211> 20
 <212> DNA
 <213> Artificial

<220>
 <223> gene-specific primer containing restriction site

<400> 7
 gagttcaggc cgacgatgac

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<210> 8
 <211> 20
 <212> DNA
 <213> Artificial

<220>

<223> gene-specific primer containing restriction site

<400> 8

atcggcgatg tcgtgcaatc

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<210> 9

<211> 368

<212> PRT

<213> Triticum aestivum

<400> 9

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Gly Arg Phe Leu Leu Tyr Asn Ile Phe Gly Asn Gln Phe Glu Thr Thr
20 25 30

Ala Lys Tyr Gln Pro Pro Ile Met Pro Ile Gly Lys Gly Ala Tyr Gly
35 40 45

Ile Val Cys Ser Val Met Asn Phe Glu Thr Arg Glu Met Val Ala Ser
50 55 60

Lys Lys Ile Ala Asn Ala Phe Asp Asn Asn Met Asp Ala Lys Arg Thr
65 70 75 80

Leu Arg Glu Ile Lys Leu Leu Leu Arg His Leu Asp Glu Asn Ile Val
85 90 95

Gly Leu Arg Asp Val Ile Pro Pro Ala Ile Pro Gln Ser Glu Asn Asp
100 105 110

Val Tyr Ile Ala Thr Glu Leu Met Asp Thr Asp Leu His His Ile Ile
115 120 125

Arg Ser Asn Gly Glu Leu Ser Glu Glu His Glu Gln Tyr Phe Leu Tyr
130 135 140

Gln Leu Leu Arg Gly Leu Lys Tyr Ile His Ser Ala Asn Val Ile His
145 150 155 160

MAPK5.ST25

Arg Asp Leu Lys Pro Ser Asn Leu Leu Leu Asn Ala Asn Cys Asp Leu
165 170 175

Lys Ile Cys Asp Phe Gly Leu Ala Arg Pro Ser Ser Glu Ser Asp Met
180 185 190

Met Thr Glu Tyr Val Val Thr Arg Trp Tyr Arg Ala Pro Glu Leu Leu
195 200 205

Leu Asn Ser Thr Asp Tyr Ser Ala Asn Ile Asp Val Trp Ser Val Gly
210 215 220

Cys Ile Phe Met Glu Leu Ile Asn Arg Ala Pro Leu Phe Pro Gly Arg
225 230 235 240

Asp His Met His Gln Met Arg Leu Ile Thr Glu Val Ile Gly Thr Pro
245 250 255

Thr Asp Asp Asp Leu Gly Phe Ile Arg Asn Glu Asp Ala Arg Arg Tyr
260 265 270

Met Arg His Leu Pro Gln Phe Pro Arg Arg Ser Phe Pro Gly Phe Pro
275 280 285

Lys Val Gln Pro Ala Ala Leu Asp Leu Ile Glu Arg Met Leu Thr Phe
290 295 300

Asn Pro Leu Gln Arg Ile Thr Val Glu Glu Ala Leu Glu His Pro Tyr
305 310 315 320

Leu Glu Arg Leu His Asp Val Ala Asp Glu Pro Ile Cys Thr Asp Pro
325 330 335

Phe Ser Phe Asp Phe Glu Gln His Pro Leu Thr Glu Asp Gln Met Lys
340 345 350

Leu Ile Pro Glu Asn Glu Ala Leu Glu Leu Asn Pro Asn Phe Arg Tyr
355 360 365

<210> 10
<211> 371
<212> PRT

<213> Nicotiana tabacum

<400> 10

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 20 25 30

Phe Gly Asn Phe Phe Glu Ile Thr Thr Lys Tyr Arg Pro Pro Ile Met
 35 40 45

Pro Ile Gly Arg Gly Ala Tyr Ile Val Cys Ser Val Leu Asn Thr Glu
 50 55 60

Leu Asn Glu Met Val Ala Val Lys Lys Ile Ala Asn Ala Phe Asn Tyr
 65 70 75 80

Met Asp Ala Lys Arg Thr Leu Arg Glu Ile Lys Leu Leu Arg His Leu
 85 90 95

Asp His Glu Asn Val Ile Gly Leu Arg Asp Val Ile Pro Pro Pro Leu
 100 105 110

Arg Arg Glu Phe Ser Asp Val Tyr Ile Ala Thr Glu Leu Met Asp Thr
 115 120 125

Asp Leu His Gln Ile Ile Arg Ser Asn Gln Gly Leu Ser Glu Asp His
 130 135 140

Cys Gln Tyr Phe Met Tyr Gln Leu Leu Arg Gly Leu Lys Tyr Ile His
 145 150 155 160

Ser Ala Asn Val Leu His Arg Asp Leu Lys Pro Ser Asn Leu Leu Val
 165 170 175

Asn Ala Asn Cys Asp Leu Lys Ile Cys Asp Phe Gly Leu Ala Arg Pro
 180 185 190

Asn Ile Glu Asn Glu Asn Met Thr Glu Tyr Val Val Thr Arg Trp Tyr
 195 200 205

Arg Ala Pro Glu Leu Leu Asn Ser Thr Asp Tyr Ser Ala Ala Ile Asp
210 215 220

Val Trp Ser Val Gly Cys Ile Phe Met Glu Leu Ile Asn Arg Lys Pro
225 230 235 240

Leu Phe Pro Gly Lys Asp His Ile His Gln Met Arg Leu Ile Thr Glu
245 250 255

Val Ile Gly Thr Pro Thr Glu Ala Asp Leu Gly Phe Leu Gln Asn Glu
260 265 270

Asp Ala Arg Arg Tyr Ile Arg Gln Leu Pro Gln His Pro Arg Gln Gln
275 280 285

Leu Ala Glu Val Phe Pro His Val Asn Pro Leu Ala Ile Asp Leu Val
290 295 300

Asp Lys Met Leu Thr Phe Asp Pro Thr Arg Arg Ile Glu Glu Ala Leu
305 310 315 320

Asp His Pro Tyr Leu Ala Lys Leu His Asp Ala Gly Asp Glu Pro Ile
325 330 335

Cys Pro Val Pro Phe Ser Phe Asp Phe Glu Gln Gln Gly Ile Gly Glu
340 345 350

Glu Gln Ile Lys Asp Met Ile Tyr Gln Glu Ala Leu Ser Leu Asn Pro
355 360 365

Glu Tyr Ala
370